

A LIST OF NAIDIFORM OLIGOCHAETA FROM THE WATER- WORKS PLANT OF THE CITY OF OSAKA

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TWO PLATES

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While engaged in the biological survey of the water-works of the city of Osaka since July 1928, the author was able to collect many minute oligochaete-worms in the entire course of the slow sand filter plant, from the straining basin down to the sand beds for filtration, even to the underdrains of the filtered water.

Some of these worms are those species which are rather common in small creeks and ponds nearby, the others, however, are quite peculiar to this situation, being never met with at other places in the same territory. A preliminary list is given herewith in order to register the occurrence of the genera and species in the Far East and also to record one genus and 8 species which I take to be new to science. Full accounts on these new worms will be published some months later.

All the specimens except those from filtered water were obtained by means of a special mud-scraper, a device resembling the Ekman-Birge's bottom-sampler but attached to the end of a long pole, and a sieve of wire meshes. For catching the animals which may be washed out from the filter sand-bed and carried down into the underdrains, a silk plankton-net was set in the regulation-well as long as water of approximately 50 cubic metres passes through the net.

I wish to express my hearty thanks to Prof. T. Kawamura for his kind advice and supervision.

FAMILY: AEOLOSOMATIDAE

Genus: *Aeolosoma*

1. *Aeolosoma hemprichi* Ehrenberg (Pl. 23, fig. 1).

Body is 2-5 mm long, the colour of oil drops is usually reddish

orange. Very common throughout all the courses of the water-works system and are found in filtered water too.

2. *A. niveum* Leydig. (Pl. 23, fig. 2).

Length of the body is ca. 2 mm, oil drops are yellowish green in general coloration or less frequently colourless. The setae of all segments are prolonged as long as the body diameter at least. Rather common in the straining basin and the sand-beds of filters.

FAMILY: NAIDIDAE

Genus: *Chaetogaster*

3. *Chaetogaster limnaei* K. Baer (Pl. 23, fig. 3).

Usually found attached to *Lymnaea japonica* Jay, but may be seen also free floating in the water, even in the filtered water.

Genus: *Schmardaella*

4. *Schmardaella filiformis* (Schmarda) (Pl. 23, fig. 4).

Body ca. 2 mm long. Prostomium well developed and no dorsal setae. The ventral bundle of the setae begins at the second segment, and is each composed of two single pointed sigmoid setae with nodulus. Rather common in the whole system from spring to autumn. In one case an unusually large form was found mixed with the small typical animals. The body length of this giant form was twice or three times as long as the typical one, and number of segments was similarly twice or three times as many as that of the latter. No chain-form was seen. Therefore the identification of this major form is rather doubtful even though other characteristics looked quite satisfactory.

Genus: *Osaka*, nov.

The animal on which I propose to establish this new genus is allied to both *Paranais* and *Ophidonais*, agreeing with them in lacking the hair setae, but differs from the former of these two in that all setae have a single pointed end, instead of being a doubly pronged crotchet. It also differs from the latter of the two in that the dorsal bundle of the setae is similar in structure to the ventral bundle, and also that the dorsal setae begin at the second segment instead of at the sixth segment.

5. *Osaka shimasakii* gen. et sp. nov. (Pl. 23, fig. 5).

Body length is ca. 5 mm, cylindrical, colourless. Often seen in

chain-form. Each single animal has 12-20 body segments. Head conical with round apex, no proboscis-like elongation, without any eye-spot. Digesting tract simple. Two bundles of the setae on each side, both the dorsal and the ventral setae equal in structure, and begin at the second segment, each being composed of 4-6 setae, which are of sigmoid shape with a distal nodulus, and the distal end of the setae is sharply pointed, but not forked at all.

Numerous specimens were collected in the filter bed in the water-works of the city of Osaka, in April 1932.

Genus: *Paranais*

6. *Paranais naidina* Bretcher (Pl. 23, fig. 6).
Fairly common everywhere.
7. *P. litoralis* Müller et Oersted (Pl. 23, fig. 7).
Rather uncommon, found hitherto only in a straining basin.
8. *P. heteroseta* sp. nov. (Pl. 23, fig. 8).

Body ca. 5 mm long, cylindrical, colourless. Head rounded and comparatively slender from following segments; without any eye-spot. Both the dorsal and the ventral bundles of the setae start at the second segment. The dorsal bundle of the setae is composed of 3-4 double pronged sigmoid setae in the anterior half of the body-segments, but is composed of single pointed sigmoid setae in the posterior half, resembling those of *Schmardaella* or *Osaka*. The ventral bundle of the setae is composed of 3-4 sigmoid setae with doubly pronged distal end.

This worm has been collected in the sand-bed for filtration together with *Osaka shimasakii* and *Paranais naidina*, in April 1932.

Genus: *Stylaria*

9. *Stylaria lacustris* Linné (Pl. 23, fig. 9).

This species, which is so common in the straining basin, showed a fluctuation of population, increasing in every other year, i. e. was rather abundant in 1929 and 1931, and almost completely disappeared in 1930 and 1932.

Genus: *Nais*

10. *Nais variabilis* Piguet (Pl. 23, fig. 10).

Most common species in the entire course, from the raw water down to filtered water. Especially it was very abundant in the sand-bed of the filters, several times being recorded more than 3000 worms per 100

sq. cm. The alimentary tract of this species is usually swollen suddenly in the seventh segment, but it has been found in several cases such a form as that with an alimentary tract swelling suddenly on the level of the eighth segment.

11. *N. elinguis* Müller et Oersted (Pl. 23, fig. 11).

Rather common, always accompanied with the foregoing species, but it has never been abundant as that.

12. *N. japonica* sp. nov. (Pl. 23, fig. 12).

Body ca. 10 mm long, cylindrical, colourless. Head round and obtuse, without any eye-spot. The dorsal bundle of the setae beginning at the fifth segment, is composed of two setae, one long hair-like, but not so long as the diameter of the body; the other short, needle-shaped, with the double pronged end and the distal nodulus. The ventral bundle starts at the second segment and is composed of from three to five short, rather thick sigmoid setae which have short bifurcate distal terminations, and the under prong of them is shorter but rather thicker than the upper. The alimentary canal shows a gradual swelling at the seventh segment. This species was detected in the filter bed accompanied with *N. variabilis*. It is well characterized by the absence of the eye-spot, and the presence of the dorsal setae in all segments from the fifth onwards.

Genus: *Dero*.

13. *Dero limosa* Leidy (Pl. 24, fig. 13).

Occasionally found in straining basins.

14. *D. kawamurai* sp. nov. (Pl. 24, fig. 14).

A rather large form, the chain reaching in length more than 20 mm. A chain-form of as many as 110 segments is not rare. The body is cylindrical, pale reddish brown in general coloration, and the head is round, rather conical and blind. The dorsal bundle of the setae begins at the sixth segment, and each bundle is composed of one long simple hair-like and one short needle-shaped setae, the latter being provided with a bifurcate distal end. The ventral bundle starts at the second segment, each of which is composed of bifid crotchet with a rather proximal nodulus. There are four setae in each bundle on the anterior body segment and one or two on the posterior, and those of from the second to the fifth segment are longer than those of the following segments. The hind end is more or less flattened and it is produced to a pentagonal disc with a dorsal lip. The ventral margin, however,

is rounded, while the concave dorsal side is occupied by three pairs of branchial processes. The dorsal lip is prolonged moderately with a short notch in the median, on which it has a pair of secondary branchial processes.

In many respects this species is closely allied to *D. incisa* Michlsn., but they can be easily distinguished from each other, since the hind ventral margin of the disc has a median excavation in *D. incisa*, while this edge is, on the contrary, produced to form a median prominence in the present species.

Numerous specimens were obtained in various seasons from the straining basin, occurring mixed with above-mentioned *D. limosa*, as well as the following species, *D. tanimotoi*.

15. *D. tanimotoi* sp. nov. (Pl. 24, fig. 15).

Body 15-20 mm long, cylindrical, fainted reddish brown. A single animal observed consisted of 35-45 segments. The head round and obtuse without any eye-spot. The dorsal bundle of the setae begins at the sixth segment and is composed of two setae, one hair-like, the other double pronged needle; several bundles of the posterior body, however, having no more of the hair seta. The ventral bundle of the setae is composed of bifid crotchet with a rather proximal nodulus, occurring in all segments from the second distalward. Each bundle of the anterior body-segments has 4-5 setae and diminishing to two or one in that of the posterior segments. These setae are nearly equal in their lengths. The hind end is produced in a disc-shape with the dorsal lip, being provided with three pairs of branchial processes on the dorsal side of the end. A pair of secondary brachial processes also are prolonged from each side of ventral margin, and are directed towards the dorsal side, parallel to the primary processes in the natural situation.

This species seems to be allied to both *D. incisa* and *D. kawamurai*, but differs from the former of these two in that neither ventral margin is depressed, nor is the disc in the shape of a rectangle. It differs from the latter species in that the secondary branchial process is located at the ventral margin instead of the dorsal lip.

Several specimens have been obtained in August 1932 from the straining basin, frequently mixed with the two species last mentioned.

Genus: *Pristina*

16. *Pristina rosea* Piguet (Pl. 24, fig. 16).

This species is very common throughout the whole system, occur-

ring together with above-mentioned *Nais variabilis*, and being often recorded more than 5000 worms per 100 sq. cm of the sand bed. All specimens that were obtained in this entire course are well marked by the presence of special bifid needle setae, the under prong of which is longer than the upper prong; but it differ from ordinary *rosea* in that its ground colour is pale chalk-white or colourless, instead of red.

Some authors distinguished the genus *Naidium* from *Pristina* on account of the presence of the bifid needle setae in the dorsal bundle or the absence of the proboscis-like elongation of the prostomium; or owing to the latter character only. If the genus *Naidium* would be accepted, *P. rosea* and *P. pinniseta* should naturally be included in *Naidium*.

Here it may not be a wrong place to refer to a specimen of this species which I detected on 10th April, 1933. (The worm had a short conical protuberance on the ventral side at about a half way from the head, i. e. the 11th segment of the first individual of a chain. This lateral process or a bud of stolonization was provided already with five pairs of the ventral bundles. I kept this interesting individual in a small glass basin and continued my careful observation of its future development. After two days this side-process showed a marked indication of prolongation and then there appeared three pairs of dorsal setae. After two days more the bud was seen distinctly to be composed of more than seven segments. On 17th April the bud was provided with eleven segments and showed the commencement of a transverse division at the middle portion of the bud. On 20th April the bud, which became already a chain of two individuals, was almost separated from the mother chain. It is by no means uncommon in Polychaeta that such a type of stolonization takes place either in nature or under experimental treatment, but it is rather unusual, as far as I know, in the Naididae. Presumably a wound or some other kinds of stimulation given to the ventral nerve cord had been the cause of the regenerating process, which then went by itself as far as to complete a ramifying mode of the reproduction.

17. *P. pinniseta* sp. nov. (Pl. 24, fig. 17).

Body cylindrical, with tapering head but without proboscis-like elongation, rather short, ca. 2 mm long. 13 body segments. The most characteristic eye-spots are present. The bundles of the setae, both dorsal and ventral, start at the second segment. The dorsal bundle is composed of one or two long capiliform setae, i. e. with series of short

hairs on convex side. The ventral bundle is composed of two bifid sigmoid setae with a proximal nodulus.

A single solitary individual was found in the straining basin. It is not clear whether it occurs in chain-form or not.

This species is well characterized by the presence of an eye-spot, a round prostomium, and denticulate capiliform setae only in the dorsal bundles.

18. *P. longiseta* Ehrenberg (Pl. 24, fig. 18).

Found from various parts of the filtering sand bed.

19. *P. capiliseta* sp. nov. (Pl. 24, fig. 19).

Body-length 3-4 mm; number of segments in single animal ca. 20. Prostomium prolonged like a tentacle, without any eye-spot. The dorsal bundle of the setae which begins at the second segment, is each composed of two forms of the setae; one is of long denticulate capiliform setae, one or two in number in each bundle and the other, short double pronged needle seta, one in each bundle. The ventral bundle, which starts at the second segment, is composed of the bifurcated crotchets, three or four in each bundle.

This species agrees somewhat with *P. longiseta* in the form of the dorsal setae, but differs from it in that the absence of extraordinarily long setae on the third segment. Another allied species *P. flagellum* of North America has a flagellate elongation of the tail end which is not the case with the present species. All the other species of *Pristina*, including apparently very similar species *P. equiseta* Bourne, differ from the present one in lacking the denticulate capiliform setae.

A few specimens have been detected in the filter bed in August 1932.

20. *P. nasalis* sp. nov. (Pl. 24, fig. 20).

Body 2.5-3.5 mm long, cylindrical; head has a proboscis-like elongation. Colourless or faint chalk-white. The dorsal bundle of the setae begins at the second segment, and each is composed of two forms, one bifid needle and the other hair-like; the latter of these two forms is rather twice as long as the diameter of the body in the second and the third segments; and in the following segments more than twice. The ventral bundle of the setae occurs in all segments from the second onwards, and each is composed of 3-4 sigmoid bifurcate setae with rather distal nodulus.

This species resembles *P. breviseta* Bourne and *P. foreli* Piguet, but differs in the following points: *P. breviseta* has the shorter hair

setae on the second and the third segments than those on the following segments and this character conforms to the present species. The prostomium, however, is not elongated as a long proboscis. *P. foreli* has an elongated head, but the dorsal hair setae are as long as twice the diameter of the body in the middle body-segments only.

Rather common in the whole system from May to October.

P. S. Tubificid-worms are rather common in creeks and ponds near the plant but very rare in the course of the water-works system, *Tubifex* sp. having been recorded in several cases only in the straining basin.

Enchytraeid-worms, which have been scarcely recorded from Japan, were also found in both the straining basin and in the filtering sand bed. They are, however, very rare, and I am not yet supplied with any good specimens for the identification of genera and species.

EXPLANATION OF PLATE 23

Fig. 1. *Aeolosoma hemprichi* Ehrenberg, $\times 33$. 1a; hair setae of dorsal bundle of segm. II, $\times 250$.

Fig. 2. *Aeolosoma niveum* Leydig, $\times 33$. 2a; hair setae of dorsal bundle of segm. V, $\times 165$.

Fig. 3. *Chaetogaster limnaei* K. Baer, $\times 33$.

Fig. 4. *Schmardaella filiformis* (Schmarda), $\times 33$. 4a; setae of segm. II, $\times 500$.

Fig. 5. *Osaka shimasakii* gen. et sp. nov., $\times 33$. 5a; dorsal setae of segm. II, $\times 500$. 5b; ventral setae of segm. II, $\times 500$.

Fig. 6. *Paranaïs naidina* Bretcher, $\times 33$. 6a; dorsal seta, $\times 500$. 6b; ventral seta, $\times 500$.

Fig. 7. *Paranaïs litoralis* Müller et Oersted, $\times 33$. 7a; dorsal seta of segm. V, $\times 500$. 7b; ventral seta of segm. II, $\times 500$.

Fig. 8. *Paranaïs heteroseta* sp. nov., $\times 33$. 8a; dorsal seta of segm. V, $\times 500$. 8b; dorsal seta of segm. XII, $\times 500$. 8c; ventral seta of segm. III, $\times 500$. 8d; ventral seta of segm. XII, $\times 500$.

Fig. 9. *Stylaria lacustris* Linné, $\times 33$. 9a; ventral seta, $\times 165$.

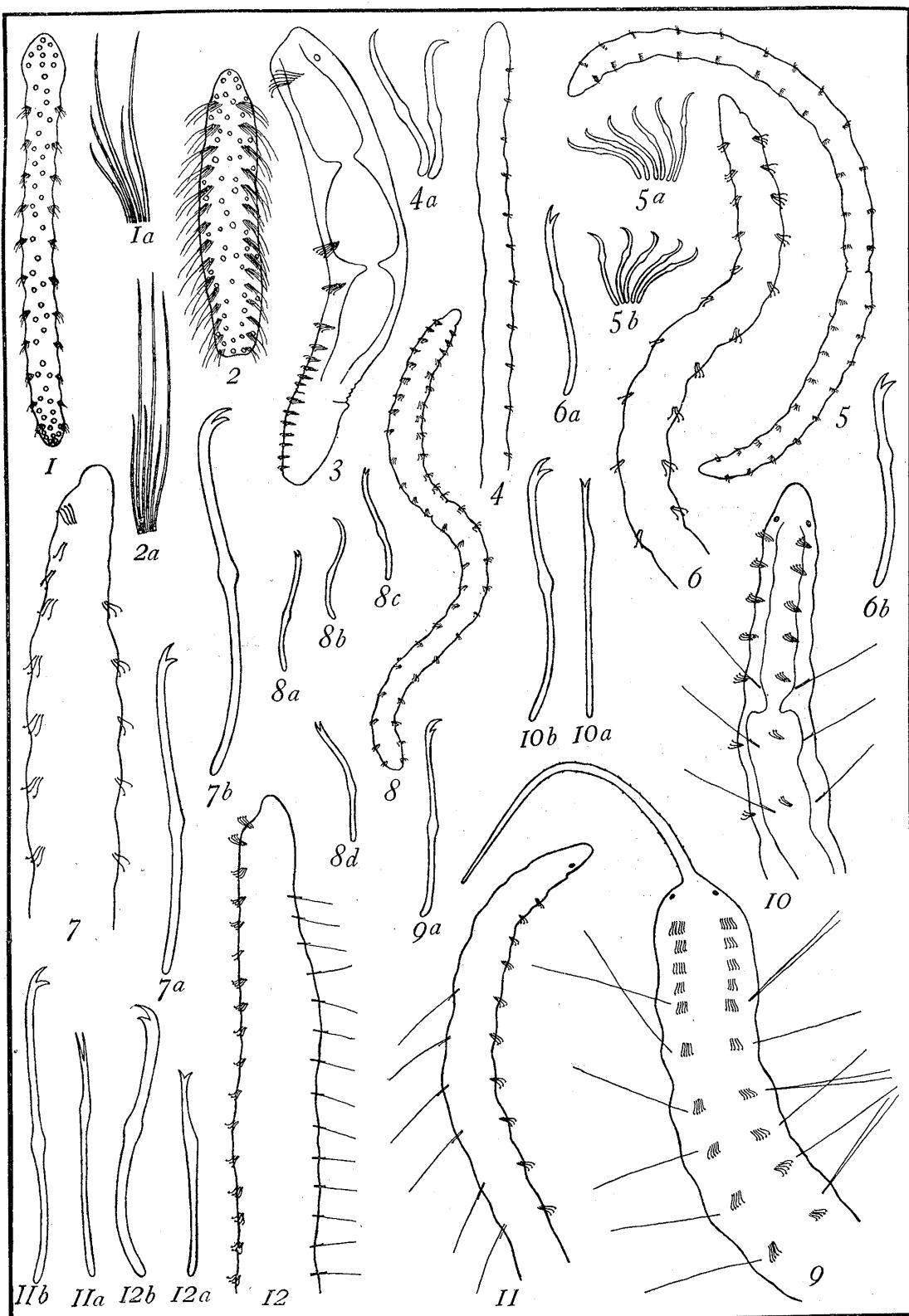
Fig. 10. *Nais variabilis* Piguet, $\times 33$. 10a; dorsal needle seta, $\times 500$. 10b; ventral seta of segm. IV, $\times 500$.

Fig. 11. *Nais elinguis* Müller et Oersted, $\times 33$. 11a; dorsal needle seta, $\times 500$. 11b; ventral seta of segm. II, $\times 600$.

Fig. 12. *Nais japonica* sp. nov., $\times 33$. 12a; dorsal needle seta of segm. V, $\times 500$. 12b; ventral seta of segm. II, $\times 500$.

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PLATE 23



EXPLANATION OF PLATE 24

Fig. 13. *Dero limosa* Leidy, $\times 33$. 13a; hind end, $\times 66$. 13b; dorsal needle seta, $\times 165$. 13c; ventral seta of segm. III, $\times 165$. 13d; ventral seta of middle body-segment, $\times 165$.

Fig. 14. *Dero kawamurai* sp. nov., $\times 33$. 14a; hind end, $\times 66$. 14b; dorsal needle seta, $\times 165$. 14c; ventral seta of segm. III, $\times 165$. 14d; ventral seta of segm. XVIII, $\times 165$.

Fig. 15. *Dero tanimotoi* sp. nov., $\times 33$. 15a; hind end, $\times 66$. 15b; dorsal needle seta, $\times 165$. 15c; ventral seta of segm. II, $\times 165$. 15d; ventral seta of middle body-segment, $\times 165$.

Fig. 16. *Pristina rosea* Piguet, $\times 33$. 16a; dorsal needle seta, $\times 500$. 16b; ventral seta, $\times 500$.

Fig. 17. *Pristina pinniseta* sp. nov., $\times 33$. 17a; dorsal denticulate seta, $\times 165$. 17b1; ventral seta, $\times 165$.

Fig. 18. *Pristina longiseta* Ehrenberg, $\times 33$. 18a; dorsal denticulate seta, $\times 500$.

Fig. 19. *Pristina capiliseta* sp. nov., $\times 33$. 19a; dorsal denticulate seta, $\times 250$. 19b; dorsal needle seta, $\times 500$. 19c; ventral seta, $\times 500$.

Fig. 20. *Pristina nasalis* sp. nov., $\times 33$. 20a; dorsal needle seta, $\times 500$. 20b; ventral seta, $\times 500$.

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PLATE 24

